Space Weather Technical Forecast

Issued on Monday, 30 October 2023 at 00:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storms on day 1 (30 Oct). Risk decreasing thereafter. Chance of Active fluence from day 2 (31 Oct) onwards.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with a recent series of C-class flares from AR3474, peaking at C7.8 at 29/1309 UTC. This is one of three sunspot regions on the disc, with the remaining two both weak, with limited evolution. AR3474 in contrast continues to show some development. AR3474 also retains a complex beta-gamma magnetic structure. No Earth-directed CMEs have been observed.
Solar Wind / Geomagnetic Activity: Solar wind speeds observed at L1 have remained elevated between 550-600km/s as Earth remains under the influence of the high speed stream from coronal hole 66. Density is mostly below average. Total magnetic field strength was weak. The north-south component was also weak, but often negative. Phi angle has remained predominantly positive (away from the Sun). Geomagnetic activity was Unsettled to Active with two G1/Minor storm intervals at 29/0000-0300 UTC and 29/0600-0900UTC.
Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was at background to moderate but increased to high levels between 29/1520-1935UTC, peaking at 1890pfu at 29/1610UTC. The associated 24-hour fluence remains well below the Active (1e8 integrated pfu) threshold. The observation at 30/0000UTC was 3.34e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is expected, mainly from AR3474. There is a slight chance of M-class flares.
Solar Wind / Geomagnetic Activity: There are no Earth directed CMEs. The high speed stream from coronal hole 66 is currently connected to the Earth, giving solar wind speeds of 550-600 km/s. Speeds are expected to have peaked and should start declining through the period. Unsettled to Active (Kp3-4) activity is expected day 1 (30 Oct) with a chance of an isolated G1/Minor storm interval. Activity then easing through the period, with a slight chance of G1/Minor storms on day 2 (31 Oct), gradually reaching Quiet with isolated Unsettled intervals by day 3 (01 Nov).
Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background. High energy electron flux (greater than 2MeV) is forecast to be at moderate levels reaching high during the diurnal maximum. The associated 24 electron fluence is expected to see a rising trend, with a chance of reaching Active (1e8 integrated pfu) day 2 (31 Oct) onwards.

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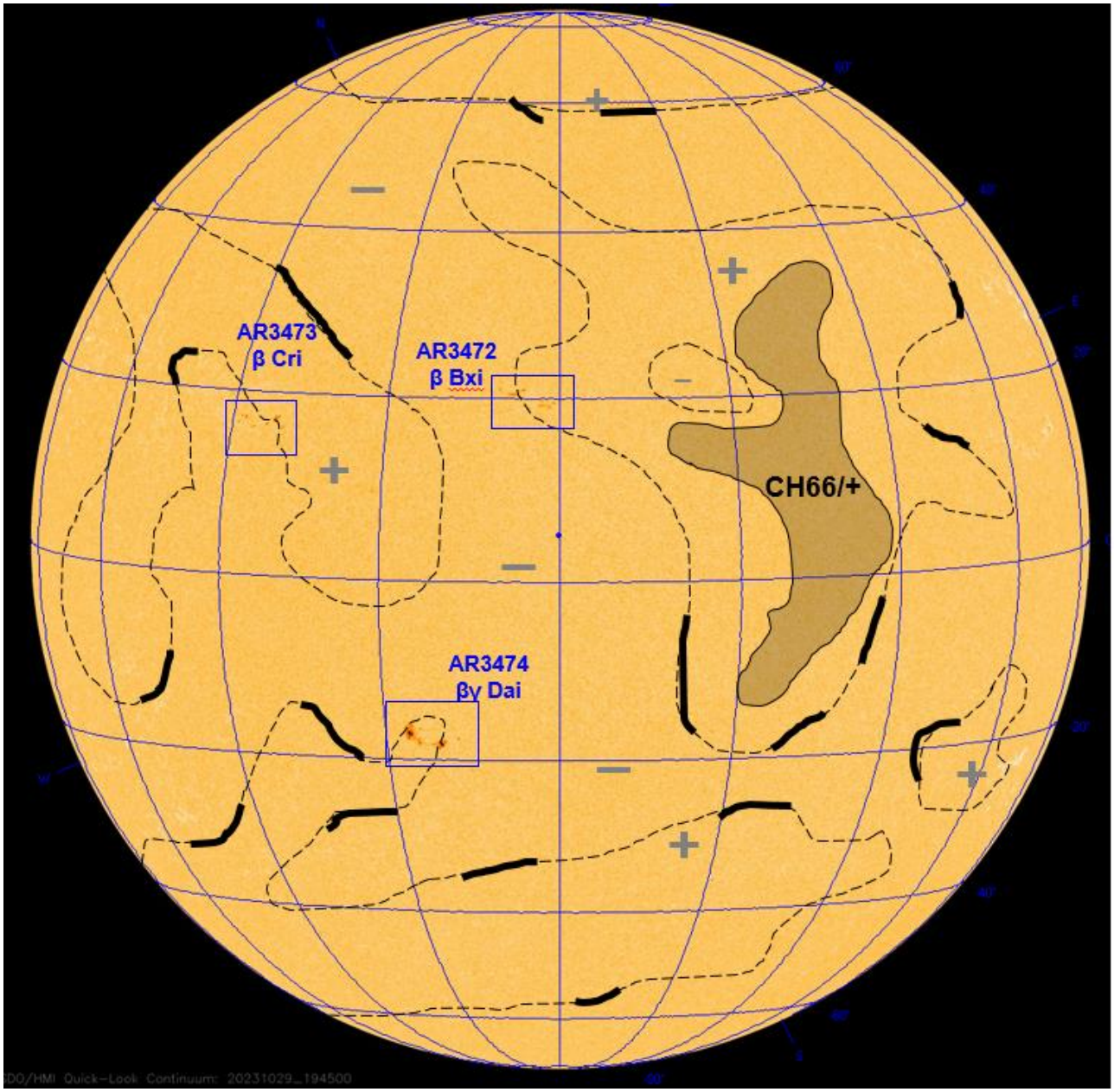
Figure 1. Solar Analysis Valid 29/2000UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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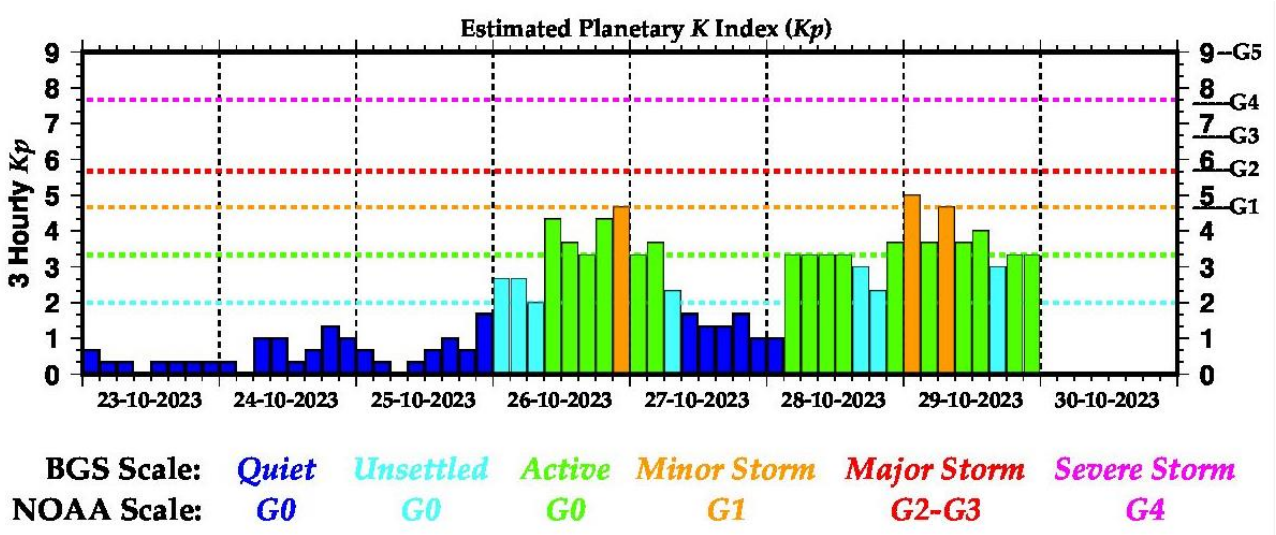
Geomagnetic Storms:

No Earth-directed CMEs are in the forecast.
Solar wind speeds have been elevated in the last 24 hours as the high speed stream from trans-equatorial coronal hole 66 in the western hemisphere connected with Earth. Speeds are around 550-600 km/s with a slow decline then likely through the period, but remaining slightly elevated through to the end of the forecast period. As this coronal hole has developed markedly from the previous rotation, persistence is of no use, although the strength of the feature suggests that the effects will continue through the next few days.
There appears to have been a notable CIR ahead if the high speed stream, which resulted in the G1/Minor Storm effects at the onset of the coronal hole. There remains a chance of further G1/Minor Storms on day 1 (30 Oct), with activity slowly easing thereafter.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	30	20	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: Estimated Planetary K index from BGS



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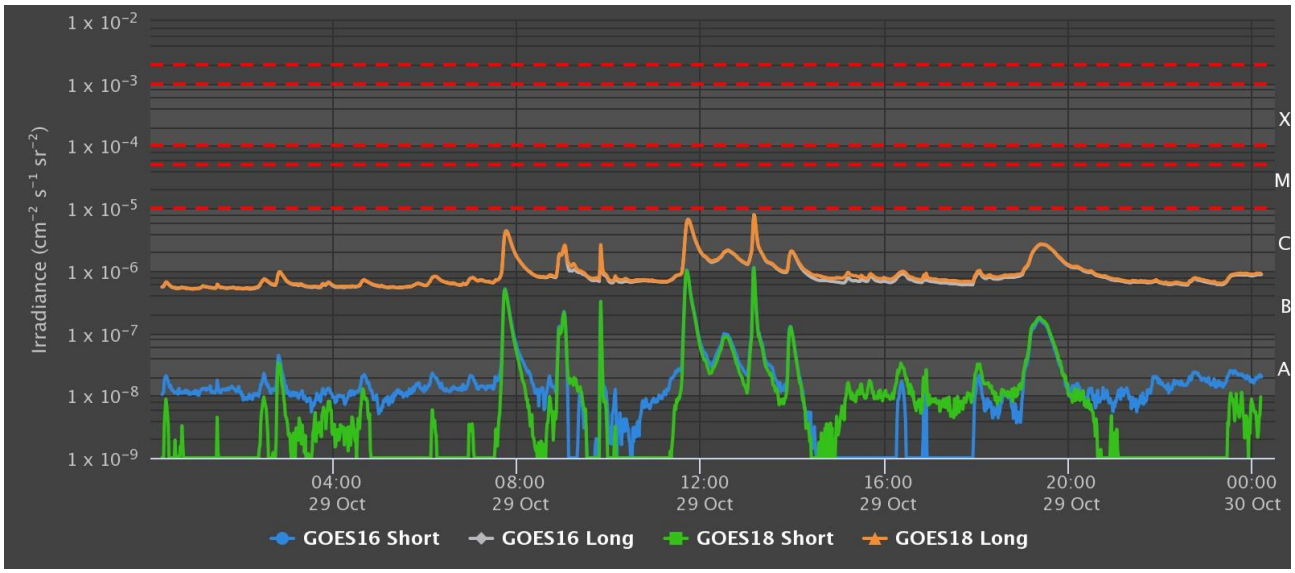
Radio Blackouts - X-Ray Flares:
Low activity is forecast with only three sunspot regions on the visible disc. AR3474 is the largest, most complex and most active region in the disc with the recent development accompanied by a series of C-class flares. The remaining regions are both simple with very limited evolution.
A couple of potentially significant sunspots are on the far side of the disc, and may rotate onto the visible side from around 01 November

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	15	25
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES18 X-Ray flux



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Solar Radiation Storms - (High Energy Protons):

The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant sunspot regions on the visible disc.

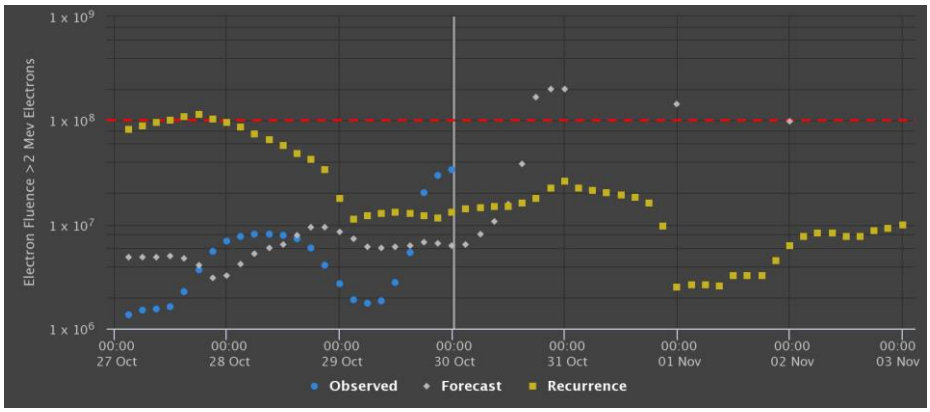
Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux is beginning to rise in response to the high speed stream from coronal hole 66 and the subsequent increase in electron populations in the radiation belts. There is an increasing chance of reaching the high threshold during the diurnal maximum through the period as geomagnetic activity ease. However the solar wind pressure as a result of the strong speeds may distort the belts, with a sharp increase possible by day 2 and 3 (31 October and 01 November) as the speeds begin to ease.
24-hour electron fluence is forecast to follow a rising trend through the next four days, with the Active threshold likely to be reached by day 3 (01 Nov). REFM is beginning to indicate a response to the solar wind enhancements and should soon start to reflect current conditions.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	20	40	55	55
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REF Model



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